This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

⑲ Europäisches Patentamt
European Patent Office
Office européen des brevets

⑪ Publication number: **0 351 952**
A3

⑫ EUROPEAN PATENT APPLICATION

㉑ Application number: **89306150.7**

㉒ Date of filing: **16.06.89**

㉚ Priority: **19.07.88 US 221410**

㊸ Date of publication of application:
24.01.90 Bulletin 90/04

(84) Designated Contracting States:
DE FR GB IT NL

(88) Date of deferred publication of the search report:
27.06.90 Bulletin 90/26

(51) Int. Cl.5: **E21B 10/56**

(71) Applicant: **SMITH INTERNATIONAL, INC.**
16740 Hardy Street
Houston, TX 77032(US)

(72) Inventor: **Jones, Kenneth William**
2007 Forest Manor
Kingwood Texas 77449(US)
Inventor: **Fyfe, George**
16206 Sir William Drive
Spring Texas 77379(US)

(74) Representative: **Enskat, Michael Antony Frank et al**
Saunders & Dolleymore 9, Rickmansworth Road
Watford Hertfordshire WD1 7HE(GB)

(54) Convex-shaped diamond cutting elements.

(57) A diamond insert (30) for a rotary drag bit (10) comprises an insert stud body (32) with a first base end and a second cutter end. The cutter end of the insert is formed in a convex or spherical shape (42) of polycrystalline diamond material (40). The convex layer of diamond (42) is oriented relative to an axis of the stud body with a negative rake angle from 0° to about 45°, inclusive. A plurality of such inserts (30) mounted in the cutting face (17) of a drag bit (10) cut earth formation with reduced friction and good cooling of the polycrystalline diamond.

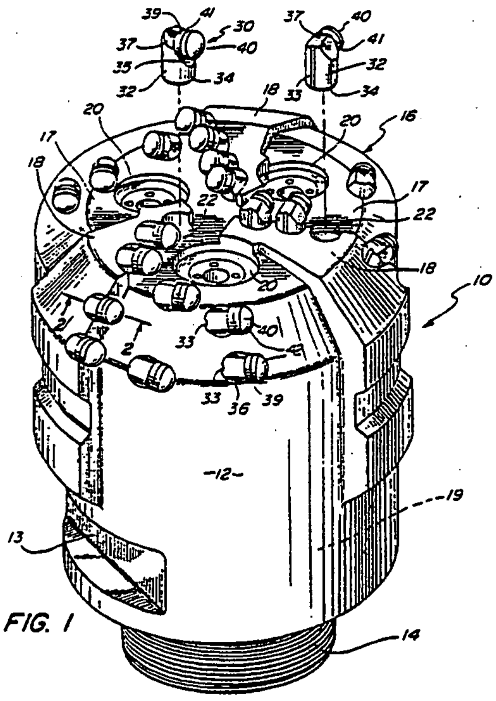

FIG. 1

internal chamber communicating with the first open pin end and one or more strategically positioned nozzles secured within the second cutting face of the bit body, the nozzles communicating between the chamber and an exterior area adjacent the second cutting face of the bit body; and
convex polycrystalline diamond cutter elements secured to the second cutter end of the diamond insert stud, the convex cutter element being oriented relative to a centerline of the cylindrically-shaped base end with a negative rake angle from 0° to about 45°, inclusive, for forcing detritus from an earth formation away from a center of the convex surface of the cutting element during a borehole drilling operation.

8. rotary drag bit as set forth in claim 7 wherein the convex-shaped cutter element is a portion of a sphere.

9. The rotary drag bit as set forth in either of claims 7 or 8 wherein the convex cutter element comprises a convex layer of polycrystalline diamond material bonded to a substantially cylindrical hardmetal backup portion, the backup portion having a first convex surface bonded to the diamond and a second base end, the second base end being metallurgically bonded to the cutter end of the insert stud.

10. The rotary drag bit as set forth in any of claims 7 to 9 wherein the base end of the hardmetal backup portion is brazed to the cutter end of the insert stud.

11. The rotary drag bit as set forth in any of claims 7 to 10 wherein the insert stud and cylindrical backup portion are fabricated from cemented tungsten carbide.

12. The rotary drag bit as set forth in any of claims 7 to 11 wherein each of the diamond inserts mounted within the insert holes in the second cutter face of the bit body is oriented with the convex polycrystalline cutter element face toward the direction of rotation of the diamond drag bit such that a center of the convex-curved surface of each of the cutter elements is substantially coincident with a radius line of the cutter face, thus providing both positive and negative side rake to the cutter elements.

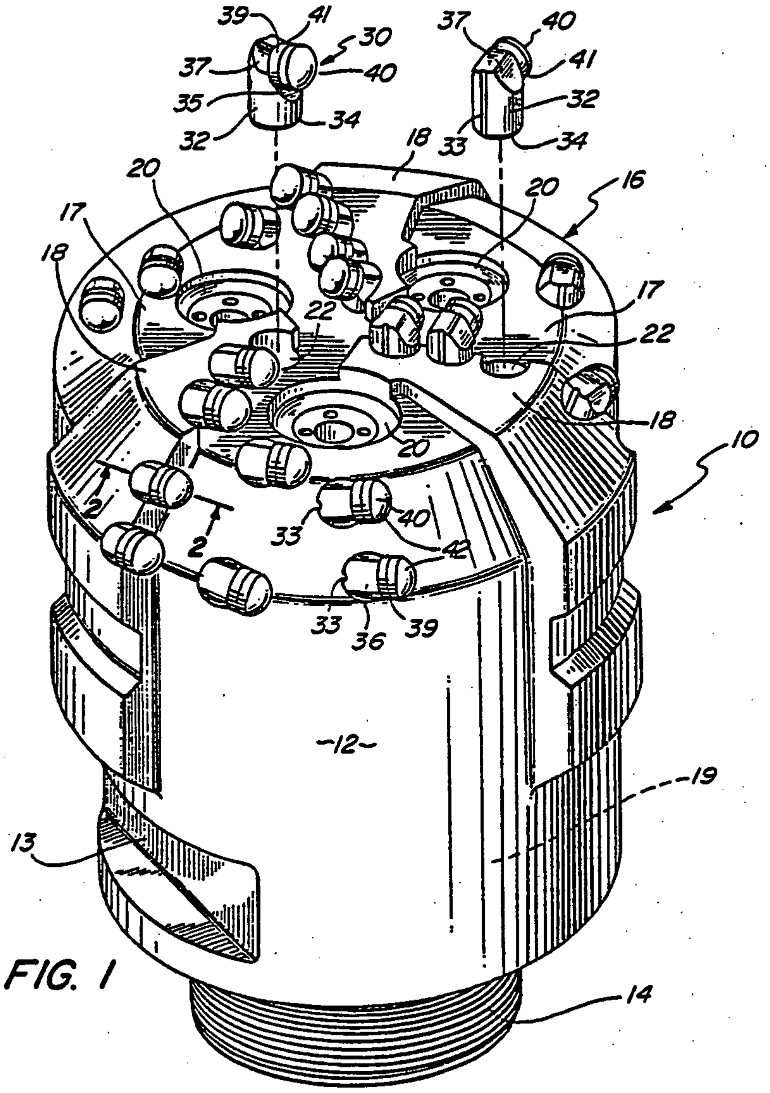

FIG. 1

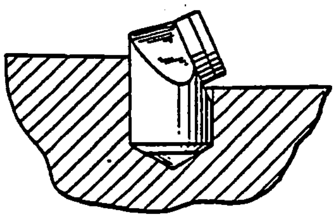

FIG. 3
PRIOR ART

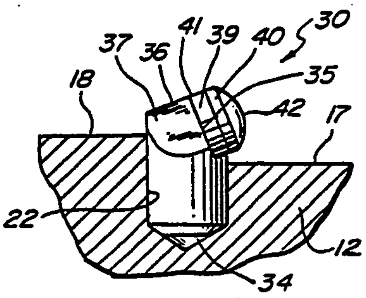

FIG. 2

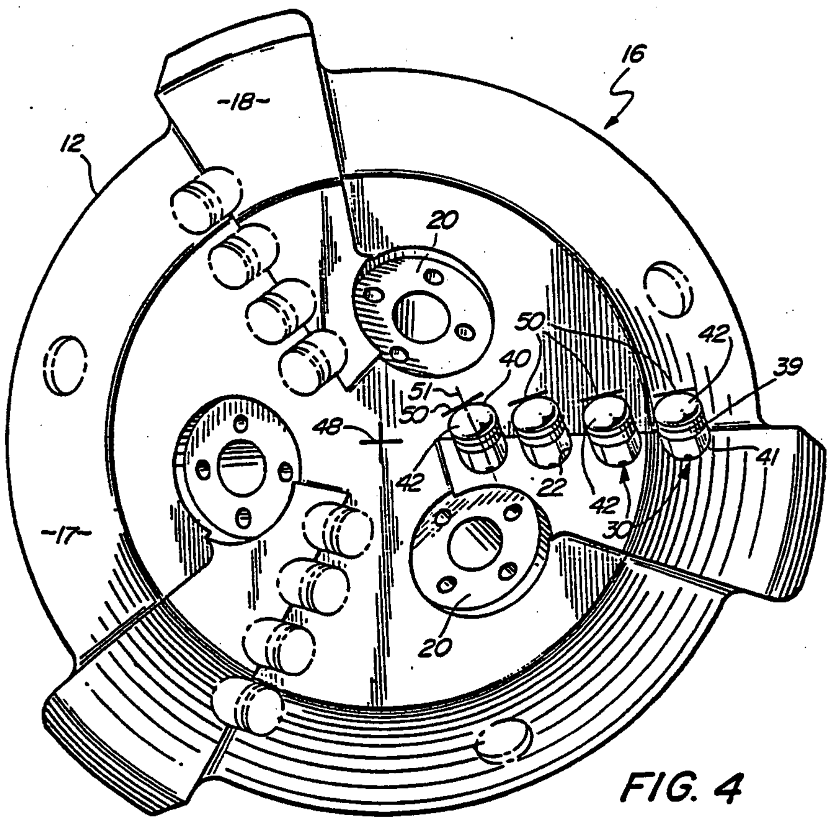

FIG. 4

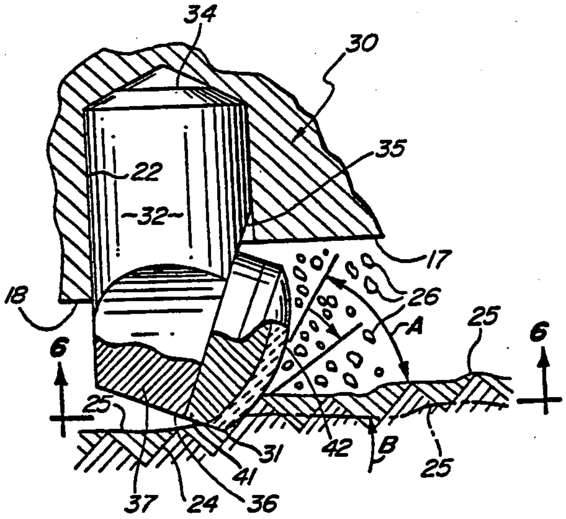

FIG. 5

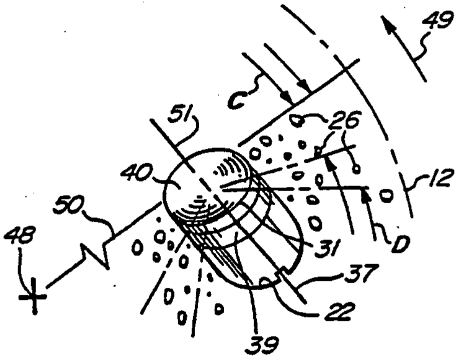

FIG. 6